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APPLIED GENERATIVE ARTIFICIAL INTELLIGENCE:
Image Creation for Speculative Heritage Reconstruction

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ABSTRACT

The research examines how generative models can contribute to addressing informational gaps in the study and dissemination of cultural heritage, not as substitutes for scientific evidence, but as tools for visual exploration and critical reflection. It analyzes the technical and conceptual boundaries between reconstruction, interpretation, and algorithmic imagination, as well as the epistemological and ethical implications arising from the use of generative artificial intelligence in heritage contexts. Through case studies focused on sculptural heritage, the article evaluates the potential of generative artificial intelligence for the formulation of visual hypotheses, artistic dissemination, and the opening of new visual narratives surrounding cultural heritage.

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1. Introduction

In recent years, generative artificial intelligence (GenAI) has moved from being an area restricted to technological development to becoming a phenomenon with a transversal impact on contemporary visual culture. Its presence in processes of image creation, design, animation, and audiovisual production has become normalized, and the idea that algorithmic systems not only "assist" creative processes but also produce visual results with the capacity for circulation, legitimation, and consumption is firmly established in the imagination of the general public. Works such as Veggi (2025) or Bartolomé and Martín (2026) demonstrate the importance that AI is acquiring in design and creative processes in general.

In the field of cultural heritage, this expansion takes on particular interest because GenAI appears as a tool capable of generating plausible—and quickly operational—representations of heritage objects from a minimal starting point of information, such as a single image.

In this work, we attempt to position ourselves at that intersection of visual culture, heritage dissemination, and technological experimentation, with the aim of exploring what happens when a sculptural heritage asset enters the flow of visual interpretation of GenAI tools oriented toward 3D representation. Although there are well-established methodologies for heritage digitization —such as photogrammetry or laser scanning— their application often requires specific logistical conditions, equipment, and advanced technical training, frequently beyond the reach of a researcher without specialized skills or without the necessary technical setup. In contrast, accessible and free web-based platforms have emerged that promise three-dimensional reconstructions from 2D images with a very high degree of automation. This accessibility suggests a change of scale—a democratization. At present, it is no longer only institutions or laboratories that can produce digital models, but also researchers without specialized infrastructure, instructors, students, or cultural creators. However, the democratization of access to visual culture through tools such as those we will analyze, and their subsequent dissemination through social media or specialized forums, raises new challenges for the study and validation of digitized heritage.

Within this framework, we can state that this research does not start from the premise of reconstruction in a literal sense —as a faithful restitution— but rather from analyzing GenAI as a visualization technology capable of producing visual hypotheses. In other words, the focus is not only on the final result —though that matters too— but on the process of generating synthetic images through AI as a tool for visual exploration. Questions such as what does the algorithm decides, what it prioritizes, what it simplifies, what it transforms, and which elements tend to be lost when dealing with sculptural heritage come to the forefront. This perspective connects with an underlying concern centered on the epistemology of heritage visualization. In the field we are working in —heritage or art history— there is a fundamental tension between the concepts of plausibility and fidelity, between reconstruction, interpretation, and speculation. We should remember that AI technologies are not neutral tools but rather incorporate the biases of their creators and of their training data.

In this study, we focus on the specific case of the so-called *Immaculate Conception of the facistol* by Alonso Cano. This figure, due to its religious character, includes elements such as the face, the hands, the folds of the garments, the textures, the compositional dynamism, and the iconographic identity, which are indispensable for the formal reproduction to be recognizable and for the study and digital conservation of the heritage piece to make sense. Starting from photographs and without providing any prior volumetric data, we will compare the results produced by several generative artificial intelligence (GenAI) platforms that, theoretically, enable the creation of three-dimensional models from a single image, considering both formal criteria and cultural and expert mediation implications.

In sum, the research proposes a comparative analysis that is applied and at the same time reflective, focused on emerging technologies of visual production. The intention is not to claim the technical superiority of GenAI, nor to reject it because of its biases, but to situate it in its complexity as a democratizing resource with the capacity to expand heritage dissemination, and also as a device that requires critical reading, methodological transparency, and expert mediation to prevent heritage from becoming a generic or decontextualized visual imaginary. Likewise, the epistemology of visualization and the active role of cultural agents in mediating these representations are emphasized, so that these technologies can be integrated into cultural heritage projects from a critical, transparent, and culturally contextualized perspective.

2. Justification and objectives

2.1. Justification

The conservation of historical, artistic, and cultural heritage has undergone a significant transformation in recent years thanks to the proliferation and development of digital technologies. There are numerous studies and projects based on emerging tools and applications such as photogrammetry, as well as scanning techniques or laser scanning and reproduction, which make it possible to capture multiple photographs and point clouds of objects or spaces in order to generate high quality digital replicas. These procedures have consolidated a highly valuable working framework for documentation, study, and heritage preservation, insofar as they enable the creation of metrically accurate models that can be reused in research, restoration, museum practice, or public outreach.

However, the logistics associated with these tools present significant limitations for the development of heritage research projects. Photogrammetry, for example, can pose difficulties from the outset for a researcher without advanced knowledge of photographic capture, the use of drones for image acquisition, the systematic collection of point clouds, and post processing of the information. Likewise, for laser scanning to be accurate, it requires expensive and highly specialized equipment, as well as specific training on the part of the researcher. In addition, these techniques are often conditioned by practical factors such as physical access to the piece, institutional permissions, lighting conditions, and restrictions derived from preventive conservation, which can limit their application in certain contexts. Finally, this type of project, based on collecting multiple images, usually requires multidisciplinary teams and access to high performance computers capable of processing and refining the information obtained. In this scenario, it becomes especially relevant to explore alternative methods that are more accessible and lower cost, expanding the possibilities for a digital approach to heritage, even if from working frameworks less oriented toward metric precision and more focused on interpretive visualization.

The possibility of generating three-dimensional models through GenAI opens new avenues of inquiry for the documentation, reproduction, and dissemination of heritage assets, even in non-institutional contexts or settings with limited resources. These technologies not only make it possible to preserve the visual record of objects threatened by deterioration or characterized by gaps in available information, but they also enable alternative forms of cultural mediation, making the public communication of artistic and historical heritage more accessible. In addition, they can function as a complement, not a substitute, to established techniques such as photogrammetry or laser scanning, by offering speculative representations that are particularly useful in cases of partial loss, degradation of the heritage asset, or lack of access to rigorous digitization workflows. In other words, GenAI does not displace the documentary logic of heritage practice, but it does provide a pragmatic resource for producing visual hypotheses, outreach materials, and interpretive prototypes in early phases of projects or within mediation contexts.[1].

However, we face a dual risk. On the one hand, as Pérez Nanclares and Blanco García (2025) note, the everyday reproduction and re-production of architecture and digital visual culture is now freely shared through social media, which democratizes access to information that was previously filtered through specialized publications. At the same time, this circulation fosters the emergence of inaccurate models that are presented as certain; therefore, care must be taken to maintain rigor in the reproduction of heritage through these techniques. On the other hand, in any process involving GenAI there are pronounced biases, due, among other reasons, to the training data and to these systems' access to original sources, or lack thereof (Irala, 2024, p. 5). This point is crucial because, as can be inferred from authors such as Zhang et al. (2025), the generation of digital twins and their convergence with AI is fundamental for integrating heritage into digital environments such as the metaverse. It is precisely here that we observe the relevance of these models for heritage conservation, scientific dissemination, and knowledge transfer through, for example, repositories of virtual replicas.

Another major challenge we address is the very promise of supposedly open and free access to these tools, a promise that rests precisely on guaranteeing fidelity in reproduction or re-creation. In the heritage field, a representation is not merely a visual outcome. It is a form of knowledge and, at the same time, a device of cultural mediation. For this reason, the use of GenAI in heritage contexts poses a

[1] Works such as Shih (2025) further develop the combination of these complementary techniques..

challenge because it opens opportunities for digital conservation and public dissemination through the creation of reusable models for museum practice (Irala, 2024), education, immersive environments, documentaries, or historically grounded video games, but it introduces an unavoidable speculative dimension. Where volumetric or contextual information is missing, the system completes, interprets, and imagines according to patterns learned from its training data. As we argue, the risk is no longer limited to obvious errors or hallucinations, but extends to subtler, more unilateral interpretations, such as idealizations, stylistic homogenization, iconographic shifts, or formal decisions that can drift away from the historical and cultural context of the original without the viewer noticing.

In this study, we focus on the analysis of complex works, particularly sculpture. We chose this approach because sculpture is an art form that varies from one artist to another, leaving highly distinctive traces, and even when it draws on the same iconography, especially in the case of religious sculpture, its manner of execution is always singular. Likewise, we have observed that there is far less scholarship on heritage reconstruction of complex forms than on architectural reconstruction.

Therefore, for our specific case, we will use as our object of study the *Inmaculada Concepción* by Alonso Cano, located in the Cathedral of Granada. As we have noted, this choice is not accidental. Compared with architectural structures, which are more regularized and more legible for many current models, a Baroque devotional sculpture presents a formal and symbolic complexity that is especially demanding for GenAI. Elements such as the face, hands, garments' folds, textures, compositional dynamism, and iconographic identity are indispensable for the formal reproduction to be recognizable and for the study and digital conservation of heritage to make sense. For precisely this reason, the work functions as an ideal case for evaluating the behavior of accessible 3D generation tools based on two-dimensional images. In addition, this sculpture has not been the subject of extensive studies and there are no images of its rear side, so the reconstruction will be carried out "blindly" and will depend entirely on the interpretation of the platforms used. Starting from a frontal photograph and without providing any prior volumetric data, we compare the results produced by several platforms, considering both formal criteria and cultural implications.

The potential of GenAI to represent elements that are damaged or no longer exist today therefore opens a path of exploration that combines visual restitution with algorithmic imagination. However, this kind of generation is not without problems. Algorithms often introduce unilateral interpretations based on training that is disconnected from the specific cultural context, which can lead to inaccurate, stylized, or visually misleading results. Here, the critical issue is not only the presence of obvious errors, but the way AI can impose "silent" decisions, proportions, features, textures, or gesture, that transform the meaning of the piece and alter its cultural reading. Hence the importance of critically considering the formal fidelity of the models obtained, their limitations, and the transparency framework required for their use in heritage contexts, especially if they are integrated into museums, educational and outreach projects, or audiovisual narratives.

2.2. Objectives

The objective of this work is twofold. On the one hand, we propose a technical and comparative objective that allows us to analyze the performance of different 3D generation platforms based on images when applied to the same artwork, evaluating their behavior in relation to criteria of formal coherence, three dimensionality, level of detail, and iconographic fidelity. On the other hand, we propose a critical and epistemological objective aimed at reflecting on the cultural, epistemic, and aesthetic implications of these artificially generated representations, from a perspective that considers both their limits and their opportunities for contemporary heritage dissemination.

In this sense, the work does not pursue only a technical evaluation but also aims to contribute to a broader debate about what kinds of knowledge can be produced when heritage is represented through algorithmic inferences, and what responsibilities emerge when that visuality is transformed into outreach material or into something that becomes culturally legitimized.

As a final objective, the work aims to outline a methodological framework that can be applied to future experiences in heritage and GenAI. This framework will make it possible to integrate and validate these tools in a critical, transparent, and culturally aware way, as resources useful for artistic dissemination, and it will clearly establish their conditions of validity, their limits, and the need, or lack thereof, for expert and multidisciplinary mediation.

3. Methodology

In this work, we adopt an exploratory methodology based on direct experimentation with GenAI tools specialized in creating 3D models from 2D images.

As our documentary basis, we draw on *The Seville Principles* (FIAV, 2017), which establish eight fundamental bases[2] that should be observed in the restoration of any heritage asset. However, we focus especially on authenticity and scientific transparency, although the results of this work bear, to a greater or lesser extent, on the rest of the principles as well.

In *The Seville Principles*, virtual reconstruction is defined as follows:

> The attempt at visual recovery, based on a virtual model, of a specific moment in time of a construction or object made by human beings in the past, drawing on the existing physical evidence of that construction or object, scientifically reasonable comparative inferences, and, in general, all studies carried out by archaeologists and other experts linked to archaeological heritage and historical research. (FIAV, 2017, p. 12)

This definition serves as a starting point for the study currently underway. At the same time, we argue for the relevance of speculative virtual reconstruction, because it places the emphasis of restoration on the ability to produce reconstructions in the manner of a given author or artistic movement. For that reason, algorithmic deviations that result from AI become critical. The speculative dimension is fundamental because it can, in a certain way, reveal how generative AI models have been trained. As Moldovan, Moldovan, and Rice (2025) note, "the speculative element is not a drawback but rather a means to examine how knowledge about a site is constructed" (p. 9). In our case, we are not dealing with spaces, but the same principle can be applied to sculptures.

Table 1. Types of heritage conservation.

Concept	Method	Base
Anastylosis	Reposition of fallen original elements.	Actual physical evidence.
Restoration	Minimal intervention for preservation.	Respect for the original material
Speculative reconstruction	Create new parts “in the style of”.	Imagination and hypotheses.

Source: Author’s own work, 2026.

Finally, in order to maintain reconstructive rigor, we will pay special attention to the fidelity of these GenAI tools when converting a photographic image into a three-dimensional model. We will be able to determine the degree of fidelity by measuring formal similarity, iconographic accuracy, material re-creation, and deviations or hallucinations.

3.1. Study design

The selected figure is an *Immaculate Conception* by the Spanish Baroque sculptor Alonso Cano[3]. This small, spindle shaped free-standing sculpture, 55 cm in height and carved in the round, is also known as the *Immaculate Conception of the facistol*[4], because it was conceived as the finial of the choir lectern in the Cathedral of Granada.

The choice of this figure responds to multiple factors. First, it is a work that has not always received priority attention in heritage studies, so there is not much information online and the available photographs are limited. In addition, it represents one of the classic devotions of religious sculpture, the Immaculate Virgin, which implies a set of associated iconographic elements that should not be lost in the virtual re-creation, such as the cherubim, the clouds, and the crescent moon. Finally, given the scarcity of images available online and the practical impossibility of observing the work from all angles because it is kept in a display case, its volumetric representation becomes a technical and visual challenge. Three-dimensional reproduction will require coherence in its volumes, rigor in the expressive

[2] The eight fundamental bases that should govern the document are interdisciplinarity, purpose, complementarity, authenticity, historical rigor, efficiency, scientific transparency, and, finally, training and evaluation (FIAV, 2017).

[3] Alonso Cano (Granada, 1601-1667) was a prominent Spanish Baroque painter, sculptor, and architect, considered the founder of the Granada school of painting.

[4] A facistol is a large lectern used in the choirs of churches and cathedrals to support liturgical or choral books such as graduals and antiphonaries.

treatment of the face and hands, a strong material reading of drapery and folds, and iconographic fidelity to a culturally recognized visual imaginary.

Unlike architectural structures, whose symmetry and regularity often make digital processing easier, religious sculptures incorporate facial features, gestures, textures, and meanings that largely resist algorithmic simplifications. This condition makes the case a particularly suitable context for assessing the ability of current AI systems not only to generate coherent three-dimensional forms, but also to respect the symbolic and iconographic integrity of a Baroque devotional work.

Figure 1. Alonso Cano. *Immaculate Conception*.
Wood carving. 17th century. Cathedral of Granada. Granada. Spain.



Source: Javier Baladrón Alonso, 2021.

A single frontal photograph will be used, without any prior scanning or manual modeling, with the aim of reproducing a realistic and accessible use scenario similar to what a researcher or cultural creator without specialized technical infrastructure would face. This methodological decision makes it possible to evaluate more precisely the performance of these platforms under minimal input conditions, which reinforces the focus on accessibility and the democratization of digital reconstruction.

As for the tools we will use, we will select those that, at the time the study is conducted, offer free and accessible versions for creating 3D models from a single photograph. Some of the selected platforms provide premium services for subscribers, but for now we will do without those features. If we want to analyze the potential of this technology for cultural dissemination and the democratizing function of these tools, using free services seems a pertinent choice.

Therefore, four main tools will be used: Tripo3D, Meshy, Hitem3D, and Meta AI. Each of these tools has an image generation engine, a distinct workflow, and differentiated computational capabilities. In addition, each one states its intended approach and the kinds of results it is optimized for.

Table 2. Tools to be used and their characteristics[5].

Platform	Initial image engine	Main 3D pipeline	Key architecture	Focus/Efficiency
Tripo3D	Proprietary multi view diffusion (MIDI/TripoSR).	**TripoSR SparseRecon:** Reconstructs sparse points from a single image → mesh densification.	Single pass Sparse to Dense Transformer.	**Ultra fast efficiency** (<1s) optimized for humans and symmetries clean animatable topology.
Meshy	**Nano Banana + Flux Kontext**: Generates/refines coherent views from sketch/image.	**NeRF/Gaussian Splatting + remeshing PBR**: Initial volumetric → optimized mesh with physically based textures.	Hybrid diffusion + SDXL LoRAs.	**High fidelity for organic forms detail oriented (2 to 5 min)** ideal for heritage sculptures with realistic materials.
Hitem3D	Fused multi view diffusion (HiTem3D 1.5).	**End to end volumetric:** 1536 voxel grid directly from image → dense mesh.	Gaussian Splatting + voxel high-res.	**Detailed prototypes (2 to 5 min)** dense (2M+ faces) focused on PBR and print ready outputs despite queues
Meta AI	**SAM 3 (Segment Anything Model 3)**: Segments object/person in image/video.	**Meta 3D Gen**: Multi representation (view/volumetric/UV) with PBR diffusion.	Segmentation Transformer + diffusion.	**Experimental/open-source**; accurate in single image hybrid setups requires manual integration.

Source: Author's own work, 2026.

All these tools are designed for the same function, yet they take different approaches to their workflows. Although all of them refine results on the shared basis of Stable Diffusion, each one refines its outputs with adapted, tool specific LoRAs[6] (low rank adaptations). This variation across models is what may allow us to determine which approach is most faithful to the original model.

For the study design, we will begin with several specific premises.

- Always use the same reference image of the Immaculate Conception.
- Do not refine the instructions with written prompts if the tool offers that option.
- Always use the tool's free system or version.
- Collect images of the results from all sides.

Once the results have been obtained, we will analyze them using these criteria.

- Iconographic fidelity to the original work, assessing the preservation of recognizable features of the Immaculate Conception visual imaginary, including posture, treatment of drapery, gesture, and devotional character.
- Representation of the face and hands, since these are especially sensitive areas in devotional sculpture and highly prone to algorithmic simplification or deformation.
- Texture of drapery and folds, which is key to the Baroque identity of the work and to its material reading.
- Depth and three dimensionality, understood as stability of proportions and continuity of volumes.
- Main limitations, deviations, and errors in iconographic representation.

Table 3. Proposed analysis template.

Tool	Overall fidelity	Face/hands detail	Garment texture	Depth level	Main limitations
Tripo3D					
Meshy					
Hitem3D					
Meta AI					

Source: Author's own work, 2026.

[5] Information on how the tools work and on their technical layers is taken from the website of each platform.

[6] Low Rank Adaptation (LoRA) is an efficient fine tuning technique for large AI models such as Stable Diffusion XL (SDXL), allowing them to be customized without retraining all of their parameters. These are responsible for the hallucinations that may occur in each of the tools.

We consider that this methodology makes it possible not only to compare results, but also to make visible the biases, variations, and automatic decisions that are projected onto heritage images when there are gaps in information.

Finally, this methodology is proposed as a replicable framework for other heritage studies and can be combined with more rigorous techniques such as photogrammetry or laser scanning. In addition, it will make it possible to determine which competencies need to be incorporated into research teams working on digital heritage.

4. Case study development.

As described in the methodology chapter, to implement this case we worked from a single frontal image of the Immaculate Conception, without providing the tool with any prior volumetric data or 3D scan data.

Figure 2. Image used for 3D model generation.



Source: Manuel Guillen Guerrero, n.d.

Likewise, in all cases we used the free version of these platforms, without turning to paid features or "pro user" options. Among the functions unlocked in these advanced versions are more processing details, the possibility of feeding the generative AI multiple images, and the possibility of accessing more types of downloadable files for the 3D model. As noted, we did not use these functions for the sample. On the other hand, as a separate comment, it should be observed that the free versions of these platforms have, from the outset, an interface and workspace that can be challenging for users who are not familiar with design or 3D modeling tools.

Once the image was selected, it was uploaded to each of the tools to proceed with the reconstruction or re-creation of the three-dimensional model. We always used the same image and never refined the 3D model generation process through prompts or other means.

Each tool applied its own reconstruction criteria, filling in missing information, primarily the back of the figure, through internal estimates trained on its datasets.

In particular, the process has revealed a constant tension between two objectives that are difficult to reconcile in this type of system:

1. Achieving volumetric continuity and three-dimensional "readability".
2. Preserving specific features, material singularities, and the iconographic identity of a specific piece.

4.1. Results

Next, we proceed with the description and analysis of the results obtained, in no particular order, and we accompany the analysis with screenshots of the outputs.

The first tool, Tripo3D, generated an image that is quite similar to the original, although it includes elements that do not match the source image. The silhouette, seen from the front, is coherent and comparable to the original, but it does not preserve the tonal values of the image, and it changes the position of the face and the height of the hand. The face exaggerates the shape of the eyes and gives the figure an imprint that differs from the reference. The hands appear simplified, with a much more rigid

gesture, and the left hand disappears. From the frontal view, a schematic treatment without detail can also be seen in the faces of the cherubim, as well as the disappearance of the right horn of the crescent moon at the Virgin's feet. The base is reinterpreted in an approximate way, with a plausible appearance.

In the side views, it can be seen that the tool does not interpret the element at the figure's feet as a cloud. Its lobed design ends abruptly on the side, and the crescent moon is transformed into an orb that extends into the back. In this rear area, a green bed is added on which the figure rests, perhaps as an attempt to reproduce the terrestrial globe, as it appears in numerous representations of this devotion.

Regarding the volumes and folds of the tunic and mantle despite recreating darker colors, the design remains organic and relatively faithful to Cano's aesthetic. The drapery appears fluid, with soft and controlled curves. The treatment of the strands of hair is also very similar to what is seen in the frontal view and therefore maintains that classicizing register.

The result points to a generic canon of visual beauty learned by the model, which makes it more of a reinterpretation than a reconstruction. In this sense, Tripo3D seems to prioritize overall anthropomorphic consistency over fidelity of detail. It resolves what it does not recognize through standardized approximations and shows limitations in completing gaps in information in a natural or faithful way, as occurs with the eliminated hand.

Figure 3. Results of generating a 3D model from a photograph in Tripo3D.



Source: Author's own work, 2026.

Meshy produced a solid and promising result. The first thing that stands out about this tool is the absence of color in the 3D model, so it is not possible to determine clearly how it processes and interprets chromatic information. Its ability to translate folds, expressivity, and volume into three dimensions enabled a closer approximation to the iconography of the Immaculate Conception. Even so, relevant distortions can be observed in relation to the original image.

First, and as the most striking detail, the Virgin is depicted with braids, rather than with loose strands resting on the shoulders as in the source image. The face preserves the tilt of Cano's carving. As for the hands, they show slight simplification, although none is removed. The fingers also appear more flexed than in the original figure.

Some stiffness is visible in the drapery, particularly in the lateral areas, along with a simplification of the volumes of the fabric. In addition, the figure appears narrower at the shoulders, where part of the author's characteristic volume is lost. The iconographic elements are better resolved. The crescent moon is distinguishable, although it is not represented with precision. The cherubim have texture and the base resembles the original. The placement of the crescent moon is interpreted incorrectly on the side views and its design is deformed.

In this case, the drapery extends into the back of the figure, becoming the element on which it rests. The folds of the mantle on the rear follow a Baroque canon, although some cascades appear especially simple. Finally, there is speculation about the figure's possible hairstyle in the form of braids. A rear updo is generated with considerable detail, consistent with the logic of the hair in the frontal view.

Overall, although the tool produces clear "hallucinations," the similarity to the original face allows the result to be regarded as positive, even though it would require subsequent adjustments to the exported 3D model.

Figure 4. Results of generating a 3D model from a photograph in Meshy.



Source: Author's own work, 2026.

The results obtained with Hitem3D were a more schematic and distorted representation of the figure's reality. A clear reinterpretation of the facial features can be seen, not only through an evident flattening of the nose, which becomes wider, but also through added fullness to the lips and a rounding of the jaw. These features make the figure unrecognizable in relation to the original. Likewise, the facial features of the cherubim appear completely deformed and without definition.

The hands have not been recreated correctly. In the generated synthetic image, details are missing and some fingers are absent. The texture of the crescent moon at the Virgin's feet has been notably simplified, and the transition between the end of the tunic and the beginning of the cloud has not been differentiated, resulting in a fusion of the drapery with the hair of the left lateral cherub.

Regarding the side views, we observe that the crescent moon is preserved as an iconographic element and that the cloud at the figure's feet is interpreted in a realistic way, continuing through to the back.

In this case, although the human features of the figure are not represented with fidelity, we do observe considerable similarity between the volumes of the drapery in the original carving and those in the generated 3D image. The textile volumes on the side and rear views clearly follow a Baroque aesthetic and are very faithful to the original spirit of the carving.

We observe that in all areas where the original image contains shadows, the Hitem3D tool shows difficulty in reproducing the 3D image with fidelity. We see this in the face, the hands, the right sleeve. This tool delivers results that, while not precise, could be brought much closer to the original with subsequent work of manual reconstruction or reinterpretation.

Figure 5. Results of generating a 3D model from a photograph in HITEM3D.



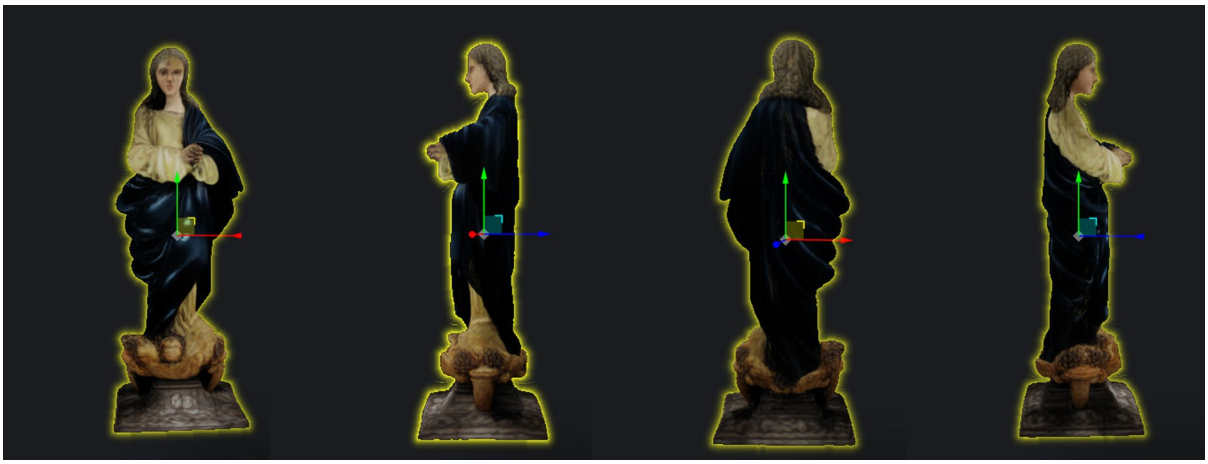
Source: Author's own work, 2026.

Finally, the results obtained with Meta AI were the least satisfactory. The generated model approaches a generic form, with no recognizable features or folds, and reads more like a diffuse figure or a sketch than a specific sculpture. This suggests that the tool, even if it delivers on its promise of generating 3D models, is not optimized for reconstruction and still does not offer performance

comparable to other solutions. If we examine the screenshots obtained, it is clear that only the drapery retains some degree of fidelity. The face, hands, base, and iconographic details are nothing more than a set of blocks that function as a visual guide, but they lack definition.

In terms of heritage conservation, this result is especially problematic because it produces a sense of three dimensionality without providing a reliable correspondence with the original. This can be misleading in outreach contexts, and it also requires extensive post processing and subsequent modeling in order to be used as a digitized model of Alonso Cano's figure. Likewise, at the time this work was carried out, it can be observed that using Meta AI requires heritage researchers to have advanced knowledge of 3D modeling and 3D image processing.

Figure 6. Results of generating a 3D model from a photograph in Meta AI.



Source: Author's own work, 2026.

Once all the results obtained have been analyzed, we proceed to present a summary table that makes them easier to understand. The following table summarizes the comparative performance of each model:

Table 4. Comparative summary of the efficiency of the GenAI tools employed.

Tool	Overall fidelity	Face/hands detail	Garment texture	Depth level
Tripo3D	Medium	Low	High	High
Main limitations	Distorted eyes, simplified and rigid hands, and the left hand disappears. The crescent moon is incomplete and deformed, the base cloud is misinterpreted, and the cherubim lack detail. It adds unverifiable rear elements and fills gaps with standardized solutions. It prioritizes overall anthropomorphic consistency over detail, drifting toward a generic canon of beauty.			
Tool	**Overall fidelity**	**Face/hands detail**	**Garment texture**	**Depth level**
Meshy	High	High	Medium	High
Main limitations	Absence of color in the 3D model. Hallucinations and distortions in specific features. A change in hairstyle. Simplification and stiffness in the drapery, loss of volume in the shoulder area, and especially simple rear cascades. Imperfect iconographic resolution. The crescent moon is recognizable but imprecise and deformed on the side views.			
Tool	**Overall fidelity**	**Face/hands detail**	**Garment texture**	**Depth level**
Hitem3D	Medium	Low	High	Medium
Main limitations	Facial reinterpretation. It alters the nose, lips, and jaw. Deformation in the cherubim and hands. Simplifications in the crescent moon. Lack of definition in texture transitions. It requires substantial subsequent manual intervention.			
Tool	**Overall fidelity**	**Face/hands detail**	**Garment texture**	**Depth level**
Meta AI	Low	Low	Medium	Low
Main limitations	Generic and diffuse result, with no definition of features, folds, or recognizable elements of the original sculpture. Only the drapery retains some degree of fidelity.			

Source: Author's own work, 2026.

Overall, these results show that the tools analyzed, in their current and free versions, while they do make it possible to obtain workable three-dimensional forms, still present difficulties when it comes to translating the symbolic and formal expressiveness of complex objects with precision. This observation does not deny their usefulness, but rather underscores the need for informed human involvement, both from a technical standpoint and from art history and heritage mediation, to avoid mistaken or decontextualized readings, and to guide subsequent digital refinement. The idea that, for technical research, "humanities scholars must be brought to the table as equal partners with technical researchers" (Kelin et al., 2025, p. 14) is reinforced. In particular, the need to incorporate layers of validation becomes evident, such as comparison with documentary sources, cross checking against formal descriptions, iconographic review, and, ideally, integration with more faithful capture techniques such as photogrammetry or laser scanning.

From a critical perspective, this experimental phase highlights the tension between visual automation and cultural and iconographic fidelity. The results suggest that, although the platforms evaluated can offer plausible representations from a compositional standpoint, they frequently fall short in expressive and symbolic aspects, especially in the faithful representation of human features.

Finally, in order to incorporate a new experimental layer into the study of the image of the *Immaculate Conception of the facistol*, two methodological decisions were introduced, derived from the comparative observation of the initial results.

First, in Tripo3D we used a feature included in the free version that allows the 3D model to be reinterpreted or regenerated from the same input photograph. The comparison between the first and second model showed noticeable variations, which suggests a degree of inconsistency in the generation procedures and, by extension, limited reproducibility under identical conditions. The differences become visible in features that are sensitive for identifying the work, such as the face, which changes noticeably, and the position of the hands. Variations in texture and color parameters can also be seen, as evidenced in the visual documentation included. Likewise, volumetric inconsistencies are observed.

Figure 7. Comparison between the first Tripo3D 3D model and the second.



Source: Author's own work, 2026.

Second, in order to examine whether there are differentiated functionalities between free and paid versions, we accessed Meshy's premium mode. This choice is justified because it was the tool that had shown comparatively superior performance in the previous phase. In the paid version, the resulting model shows greater proximity to the original reference and an increased level of detail, with less pronounced deviations than in the other cases. Nevertheless, certain shortcomings persist that are linked to modeling and to the reinterpretation of iconographic elements, which confirms that technical improvement does not fully eliminate the interpretive dimension and the biases inherent in algorithmic generation.

Figure 8. 3D model generated with the paid version of Meshy.



Source: Author's own work, 2026.

5. Discussion and conclusions

5.1 Discussion between plausibility and fidelity

The results obtained in the comparative analysis of the *Immaculate Conception of the facistol* reveal a fundamental tension in the use of Generative Artificial Intelligence (GenAI) applied to heritage, the dissonance between visual plausibility and iconographic fidelity. The tools analyzed, Tripo3D, Meshy, Hitem3D, and Meta AI, demonstrated the ability to generate coherent volumes and attractive textures that, at first glance, satisfy an expectation of a "Baroque aesthetic." However, a detailed examination through art historical criteria shows that AI tends to prioritize a generic anthropomorphic consistency over the iconographic specificity of the original. Across the board, the results reinforce a key idea. Texture and a sense of volume, even when convincing, do not guarantee heritage fidelity. This mismatch becomes especially relevant in outreach contexts, because perceptual plausibility tends to legitimize the model for the public even when its correspondence with the original is partial or uncertain.

This phenomenon aligns with what Hong (2024) calls "strategic misrecognition," in the sense that the machine's ability to generate an aesthetically plausible image can lead us to overlook serious epistemic errors. In our case, this becomes visible in the "hallucinations" observed, such as the appearance of braids instead of loose hair in Meshy, or the transformation of the crescent moon into an orb or a green bed in Tripo3D. These decisions are not innocuous, but rather statistical impositions derived from generalist and stereotypical training datasets that, as Foka and Griffin (2024, p. 7) warn, lack the specialization needed to correctly interpret complex historical attributes. The AI "recognizes" a devotional female figure and fills in gaps in information, such as the back or hidden attributes, by applying standardized patterns. In this way, the singularity of Alonso Cano's hand is softened in favor of a statistical average.

The comparative analysis also shows differentiated patterns across platforms. Tripo3D reaches high levels of depth and texture, but it introduces critical simplifications and losses, such as the elimination of a hand or the deformation of iconographic elements, which suggests a priority placed on overall anthropomorphic consistency and on standardized solutions when information is missing. Hitem3D more successfully preserves certain textile volumes and the continuity of base elements in side and rear views, although it introduces a facial reinterpretation that breaks morphological fidelity and reveals difficulties in areas with shadow. Meshy offers the most balanced performance in terms of fidelity and anatomical detail, although its colorless output limits chromatic evaluation and localized hallucinations persist, along with inaccuracies in the reading of the crescent moon. Meta AI falls below the minimum threshold for ordinary heritage uses, producing a generic form with low definition that is useful only as a preliminary volumetric guide.

From the perspective of the epistemology of visualization, the results confirm that democratizing access to these tools entails a risk of decontextualization. While authors such as Bartolomé and Martín (2026) highlight the revolution that AI has brought to design and the production of visual culture, the case study shows that technical accessibility, understood as a free and easy process, does not guarantee scientific rigor. The deformation of facial features in Hitem3D or the gestural rigidity in Tripo3D are not

mere technical failures, but symptoms of an "algorithmic imagination" operating disconnected from symbolic meaning. The AI has generated the syntax of a sculpture, but it has failed to capture its devotional semantics.

However, the validation of GenAI should not be measured exclusively by its capacity for metric mimesis, a domain in which photogrammetry remains superior, but by its potential for speculative reconstruction. The variations observed when regenerating the model in Tripo3D or when using the paid version of Meshy show that these images are not closed documents, but dynamic visual hypotheses. The challenge, therefore, lies in managing these "hallucinations" not as errors to be hidden, but as variables that must be controlled through expert supervision.

5.2 Implications for heritage and mediation

From a heritage perspective, the findings support a prudent, contextualized integration of these technologies. Their contribution lies mainly in generating interpretive prototypes, mediation materials, and the formulation of visual hypotheses in early phases, especially when it is not feasible to deploy photogrammetry or laser scanning. By contrast, when the goal is precise documentation or digital conservation with metric ambitions, these tools are defensible only as a complement and not as a substitute for evidence-based methodologies.

At the epistemological level, the experiment shows that generative AI is not limited to reproducing forms but produces visuality through inference. Where data are missing, the system fills in, normalizes, and decides which features to emphasize, which textures to simplify, and which iconography to transform. In Baroque devotional sculpture, these decisions are especially significant because cultural reading depends on expressive and symbolic details that cannot be treated as merely ornamental. Hence expert mediation and methodological transparency must be understood as enabling conditions for responsible heritage use, in line with the principles of authenticity and transparency in virtual archaeology set out in *The Seville Principles*.

5.3 Study limitations and future lines of research

The design based on a single frontal image, chosen to simulate an accessible use scenario, limits the scope for evaluating real volumetric correspondence. This constraint defines the scope of the work. We do not assess metric restitution, but rather the models' behavior when faced with gaps in information and their tendency to standardize solutions. In addition, the comparison relies on specific versions of platforms that evolve rapidly, which makes it advisable to update the protocol periodically and replicate the tests.

As future lines of research, it is pertinent to incorporate two extensions. The first is the controlled repetition of runs per tool in order to measure stability and variability. The second is the introduction of incremental input conditions, combining the frontal image with additional views or minimal volumetric cues, to observe whether hallucinations are reduced and which features become more stable. At a second level, a comparison with photogrammetry or scanning would make it possible to quantify geometric and material distances between the generative hypothesis and evidence-based capture.

5.4 Conclusions

This research has explored the capabilities and limits of generative artificial intelligence (GenAI) for the 3D reconstruction of sculptural heritage from 2D images. Considering the objectives set out and the results obtained, the following conclusions are drawn:

1. GenAI as a tool for previsualization and not for documentation. In its current state of development and, specifically, in the free access platforms analyzed, GenAI cannot replace metric documentation techniques such as laser scanning or photogrammetry when the goal is faithful preservation. The tendency toward iconographic simplification and the invention of details makes these models unsuitable for strict conservation uses without deep manual intervention.
2. The need for the expert. Technology is not autonomous in producing heritage meaning. The figure of the art historian or conservator becomes indispensable for detecting subtle deviations, such as an anachronistic fold or a rigid gesture, that the machine validates as correct. Human validation constitutes the filter capable of distinguishing between a plausible reconstruction and an authentic one.

3. Transparency and authenticity according to *The Seville Principles*. The ease of creating hyperrealistic models requires an ethical commitment to transparency. Following the guidelines of FIAV (2017), any dissemination of these models must be accompanied by clear metadata indicating their synthetic nature and the degree of algorithmic intervention. It is essential that the viewer be able to distinguish between the physical evidence, the frontal photographic data, and the algorithmic inference, as in the case of the invented reverse.
4. Democratization and the quality gap. The study reveals a significant gap between free versions and paid ones, evidenced in the test with Meshy in premium mode. While GenAI promises to democratize the creation of 3D content, the quality required for rigorous professional or educational use remains, in part, conditioned by economic barriers or access to advanced hardware.
5. Toward a hybrid methodological framework. The future of speculative heritage reconstruction does not lie in choosing between AI or traditional methods, but in their integration. A workflow is proposed in which GenAI functions as a generator of fast three-dimensional sketches for museum practice, immersive environments, or the restitution of lost parts, always subject to a subsequent iconographic audit.

Ultimately, generative artificial intelligence presents itself as an ally for heritage research, capable of filling gaps where documentation does not reach. However, for that research to be useful and not misleading, it must be grounded in methodological rigor, transparency, and deep knowledge of the cultural asset. Only in this way will it be possible to prevent digital heritage from becoming a collection of generic forms and to preserve the singular identity that resides in works such as Alonso Cano's.

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